REMARKS

Applicant gratefully acknowledges the examiner's decision to make the office action of November 03, 2004 non-final and thus allowing applicant the opportunity to make further amendments to the specification.

Understanding how the present invention fits into the context of a generic video source/transmission/display system is vital to comprehending the functionality of the present invention. In order for a program to be available for a subscriber to view, the program must be encoded, transmitted to the subscriber's location, decoded and displayed. In such a system, a central source location encodes the program, assembles the encoded video data into a single program transport stream (SPTS), and multiplexes the SPTS together with other SPTSs to form a multi-program transport stream (MPTS). This MPTS is commonly transmitted over a relatively high bandwidth transmission medium, for instance via satellite and/or optical fiber, to an intermediate destination, such as a local sub-station. From the sub-station, the video data must be sent to the final destination. This final transmission is referred to as the "last mile" transmission.

The bandwidth required to transmit the entire MPTS may not be available between the intermediate and final destinations due to limitations of the "last mile" transmission medium, e.g. a telephone line, and therefore it may be desirable to only transmit the SPTS containing the video a subscriber wishes to view. However, the peak bit rate of the SPTS can still exceed the available bit rate R for the video data over the "last mile", as shown in FIG. 2 of the specification. As stated in the paragraph beginning on page 1, line 20, of the specification, in the absence of the present invention, the video data of the SPTS would have to be modified to reduce the program's bit rate. This process (known as transcoding or transrating) is expensive in terms of computing resources and can reduce the quality of the video displayed to the subscriber.

The present invention overcomes the drawbacks of the prior art by providing a method that is computationally simple compared to transcoding and does not alter the video data in any way (a process which may be referred to as "data intact rate shaping"). Buffering the SPTS at the sub-station, before the "last mile", will create a delay and thereby allow the transmission of peak bit rate sections of the

SPTS to be spread out over a longer period of time thus lowering, or smoothing, the bit rate without losing any video data. During such a peak bit rate section, the fullness of a smoothing buffer, used to store the video data during the delay, will increase as more data is loaded in at the comparatively high VBR than is being transferred out at R bits per second. The fullness of the smoothing buffer will decrease during comparatively low bit rate sections of the SPTS when more data is being transferred from the smoothing buffer at R bits per second than is being received at the comparatively lower VBR. The video data leaving the sub-station travels over the "last mile" at R bits per second and is then received at its destination where it is loaded into a decoder buffer until the time arrives for the video data to be decoded.

The specification has been amended to more clearly distinguish, in the context of the present invention, the "smoothing buffer" and the "decoder buffer" as different entities that are separated by a transmission medium, such as a telephone line.

Claim 1 has been amended to more particularly define the subject matter applicant considers to comprise the present invention. Specifically, applicant amended claim 1 to refer to the buffer described therein as an "MPEG decoder" buffer rather than a smoothing buffer in order to avoid confusion with a "smoothing" buffer referenced in other claims and in the specification. Claims 2 and 3 have been similarly amended.

Claim 4 has been amended to more particularly define the subject matter applicant considers to comprise the present invention.

New claim 5 is dependent on claim 4 and has been added to more concretely define the timing of commencing the "loading" step of claim 4.

New claim 6 is dependent on claim 1 and has been added to more particularly define the specified amount of time prior to a picture's DTS that the loading of the picture into the smoothing buffer should commence.

New claim 7 is dependent on claim 3 and has been added to more concretely define the timing of commencing the "loading" step of claim 1.

New independent claim 8 has been added to more clearly distinguish the present invention over the prior art and is discussed in detail below.

New claim 9 is dependent on claim 8 and has been added to more particularly define how the method of claim 8 determines the decode time of a picture associated with a particular packet of the video transport stream.

Claims 1-4 stand rejected under 35 U.S.C. 103(a) as being unpatentable over U.S. Patent 5,287,182 to Haskell et al (Haskell) in view of U.S. Patent 5,534,937 to Zhu et al (Zhu).

The present invention, as defined by amended claim 1, relates to a method of demultiplexing a statistically multiplexed MPEG transport stream into a constant bit rate single program transport stream. The method comprises the steps of separating a variable bit rate (VBR) program from the statistically multiplexed MPEG transport stream (MTS), loading a picture from the variable bit rate program into an MPEG decoder buffer, and transferring the picture from the MPEG decoder buffer. The VBR program is composed of a series of pictures, each of which has a decode time stamp (DTS). The pictures from the VBR program are loaded into the MPEG decoder buffer at a rate that does not exceed a desired constant bit rate (CBR) and the loading of each picture commences a specified amount of time prior to the time indicated by the respective picture's DTS. Each picture is transferred from the MPEG decoder buffer to be decoded at the time indicated by the respective picture's DTS. Applicant submits that it is clear from applicant's specification that, in claim 1, time is measured relative to a program clock reference (PCR) contained within the single program transport stream.

The disclosure of Haskell relates to timing recovery for VBR video on asynchronous transfer mode (ATM) networks. Demultiplexer Unit (200) receives video data from a Multiplexer Unit 100. Decode time stamps, included in the received video data, are employed in conjunction with a system timing clock (STC) to properly display received data. The STC is derived from and latched to a system clock reference (SCR) embedded in the received video data. Underflow of the Demultiplexer Unit's Video Data Buffer 202 is alleviated by a jitter-delay (D_j) value, which causes an extra accumulation of data in the data buffer prior to decoding. Monitoring the fullness of the data

buffer and accordingly adjusting the jitter-delay obtains dynamic tracking of the jitter-delay of the channel.

Referring to FIG. 2 of Haskell, Systems Decoder and SCR Extract 201 reads the SCR values from the received video data and passes them on to STC Generator 208. A phase locked loop circuit in STC Generator 208 creates the STC signal, which is synchronized to the SCR generated by the Multiplexer Unit of FIG. 1. It is noted that the STC signal equaling an image representation's DTS is not what triggers sending the image representation from Video Data Buffer 202 to Video Decoder 204. Rather, an image representation is sent to Video Decoder 204 when the value of STC exceeds the image representation's DTS by the jitter-delay value D_j.

Referring to FIGs. 2 and 3 of Haskell, in Demultiplexer Unit 200, the oldest image representation stored in Video Data Buffer 202 is passed to Video Display Control 203. Therein, Depacketizer And DTS Extractor 301 strips the DTS from the first packet of the image representation. The remaining data in the packets are then passed to Presentation Unit Detector 304 where the image representation is held until Detect Zero Input 303 determines the STC-D_j signal being received from STC Generator 208 is equal to the DTS of the image representation currently stored in the Presentation Unit Detector 304, whereupon the image representation is passed from Presentation Unit Detector 304 to Video Decoder 204 for decoding. It is noted that when STC-D_j equals the DTS of the stored image representation, the current value of SCR will be DTS + D_j. The Demultiplexer Unit 200 repeats this process for each image representation received.

The examiner has asserted that Haskell discloses information, i.e. an image representation, is released from the Video Data Buffer 202 based on the image representation's DTS. Although not explicitly stated by the examiner, applicant assumes that the examiner considers this release of information to be equivalent to the "transferring" step of amended claim 1. Applicant respectfully disagrees with the examiner's position. The method defined by claim 1 requires that a picture be transferred from the MPEG decoder buffer at the time indicated by the picture's DTS, whereas Haskell's Video Data Buffer 202 transfers an image representation to Video Display Control 203 a time D_j after the time indicated by the image representation's DTS (Col. 5, lines 10 - 14). Haskell goes on to disclose that the

potential for buffer underflow decreases as D_1 increases (Col. 6, lines 2 - 3) and that, regardless of the fullness of Video Data Buffer 202, the value of D_1 is always raised if it falls below the value of STC-SCR (Col. 6, lines 31 - 34), thus teaching away from transferring an image representation out of the Video Data Buffer 202 at the time indicated by the image representation's DTS as is specifically required by claim 1.

The method defined by claim 1 also specifically requires that the loading of a picture into the MPEG decoder buffer commence a specified amount of time prior to the time indicated by the picture's DTS. Referring to FIG. 2 of Haskell, System Decoder And SCR Extractor 201 receives video information to be decoded from the Data Channel and passes the video information to Video Data Buffer 202 where it is stored awaiting display (Col. 4, lines 8 -11). There is no disclosure in Haskell stating or implying that the passing of video information for a given image representation should begin at a specific time relative to the image representation's DTS. Rather, applicant submits that one of ordinary skill in the art would properly infer that the video information would be passed to the Video Data Buffer 202 as soon as the video information becomes available from Systems Decoder And SCR Extract 201. Further, applicant submits that if a sufficiently large value of D_1 was used in conjunction with a sufficiently large buffer, there is nothing disclosed in Haskell inherently preventing an image representation being loaded into the Video Data Buffer 202 after the SCR, and thus the STC, has surpassed the image representation's DTS, as no image representation will be sent to Video Decoder 204 until after SCR exceeds the image representation's DTS, regardless of when the image representation was loaded into the Video Data Buffer 202 (see preceding paragraph).

In view of the foregoing, applicant submits that the invention defined by claim 1 is not disclosed or suggested by the cited references, whether taken singly or in combination, and therefore claim 1 is patentable. It follows that dependent claims 2, 3, 5, 6 and 7 are also patentable over Haskell et al in view of Zhu et al.

New dependent claim 7 requires that if a first picture is finished being loaded into the MPEG decoder buffer before the specified amount of time prior to an immediately succeeding second picture's decode time stamp, the second picture does not commence

loading until the specified amount of time prior to the second picture's DTS. However, if the first picture does not finish loading until at or after the specified amount of time prior to the second picture's DTS, then the loading of the subsequent picture into the MPEG decoder buffer commences immediately upon the completion of loading of the first picture. Thus, the method defined by claim 7 handles a picture arriving before the specified time prior to the picture's DTS differently than the method defined by claim 7 handles a picture arriving at or after the specified time prior to the picture's DTS. Regardless of Haskell's lack of disclosure of a specified time as discussed above, applicant submits that Haskell does not disclose any means by which Demultiplexer Unit 200 could make a decision regarding when to begin loading an image representation into Video Data Buffer 202 based on any criteria, let alone based on the timing of the image representation's availability.

In view of the foregoing, applicant submits that the invention defined by dependent claim 7 is not disclosed or suggested by the cited references, whether taken singly or in combination, and therefore dependent claim 7 is patentable, both independently and in light of the preceding arguments pertaining to claim 1.

The invention defined by amended claim 4 relates to a method of rate shaping a video transport stream and is similar to the demultiplexing method of claim 1 in that a variable bit rate video transport stream is adapted to be compatible with a constant bit rate transmission medium and that, if a picture becomes available earlier than the specified amount of time prior to the picture's decode timestamp, then the picture is loaded into the decoder buffer (e.g. the MPEG decoder buffer of claim 1) at the specified time. Applicant therefore submits that the foregoing arguments in support of claim 1 are equally applicable to claim 4.

Furthermore, claim 4 requires that, if a picture does become available later than the specified amount of time prior to the picture's DTS, the transferring of the picture from the smoothing buffer commences as soon as possible. Thus, the method defined by claim 4 handles a picture arriving before the specified time prior to the picture's DTS differently than the method defined by claim 4 handles a picture arriving at or after the specified time prior to the picture's DTS. As stated above in regards to new dependent claim 6,

regardless of Haskell's lack of disclosure of a specified time as discussed above, applicant submits that Haskell does not disclose any means by which Demultiplexer Unit 200 could make a decision regarding when to begin loading an image representation into Video Data Buffer 202 based on any criteria, let alone based the timing of the image representation's availability.

In view of the foregoing, applicant submits that the invention defined by claim 4 is not disclosed or suggested by the cited references, whether taken singly or in combination, and therefore claim 4 is patentable, both independently and in light of the preceding arguments pertaining to claim 1.

New dependent claim 5 is similar in scope to dependent claim 7, discussed above, and, like claim 7, the method defined by claim 5 handles a picture arriving before the specified time prior to the picture's DTS differently than the method defined by claim 5 handles a picture arriving at or after the specified time prior to the picture's DTS. Applicant therefore submits that the foregoing arguments in support of claim 7 are equally applicable to claim 5.

In view of the foregoing, applicant submits that the invention defined by dependent claim 5 is not disclosed or suggested by the cited references, whether taken singly or in combination, and therefore dependent claim 5 is patentable, both independently and in light of the preceding arguments pertaining to claim 4.

The present invention, as defined by new claim 8, relates to a method of rate shaping a video transport stream from a variable bit rate (VBR) having a maximum bit rate of N, to a constant bit rate (CBR) of M, M being less than N, the video transport stream having an embedded clock signal. The method receives a packet of the video transport stream at the VBR, compares a decode time of a picture associated with a first value of current time, and, if the decode time is no greater than T, transmits the packet at said CBR, and otherwise stores the packet until the amount of time between a second value of current time and the decode time is no greater than T, then transmits the packet at the CBR. T is a function of M and a minimum acceptable size of a downstream decoder buffer and the decode time and the first and second values of current time are relative to the embedded clock signal.

New claim 8 is similar to the rate shaping method of claim 4 in that a variable bit rate video transport stream is adapted to be compatible with a constant bit rate transmission medium and that, if a section of the video transport stream (a picture in claim 4 and a packet in claim 8) becomes available earlier than a specified amount of time prior to that section's respective decode timestamp, then the section is loaded into a decoder buffer at the specified time. Furthermore, claim 8 requires that, if a section of the video transport stream does become available later than the specified amount of time prior to the picture's DTS, the transmitting of the section commences as soon as possible. Applicant submits that the foregoing arguments in support of claim 4 are equally applicable to claim 8.

In view of the foregoing, applicant submits that the invention defined by claim 8 is not disclosed or suggested by the cited references, whether taken singly or in combination, and therefore claim 8 is patentable, both independently and in light of the preceding arguments pertaining to claim 4. It follows that dependent claim 9 is also patentable.

Respectfully submitted,

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